USER INTERFACE AND PAYLOAD COMMAND AND CONTROL

R-1D

TASK MANAGER: KAREN L. MOE
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TWO TASKS COMPRISE THIS OVERALL EFFORT. THE FIRST IS CONCERNED WITH DEVELOPING A MODULAR, MACHINE INDEPENDENT WORKSTATION DESIGN, SCIENCE OPERATIONS INTERFACE LANGUAGE AND INTERACTION TECHNIQUES. DESIGN CONCEPTS AND PROTOTYPE DEMONSTRATION OF A STATE OF THE ART PROTOTYPE WORKSTATION ARE TO BE BASED ON DEFINING USER REQUIREMENTS BY DETERMINING USER INTERFACE MODES, REFLECTING NEEDS IN SPACE AND ON GROUND, CENTRALIZED AND REMOTELY DISTRIBUTED. ACTUAL USER EVALUATIONS OF THIS HARDWARE/SOFTWARE WORKSTATION WILL FOLLOW THE INITIAL DEMONSTRATION. THE SECOND TASK AIMS AT GENERATING A COMMAND AND CONTROL SYSTEM DESIGN CONCEPT FOR SUPPORTING TELESCIENCE - A CONCEPT FOR INDEPENDENT SCIENCE USER OPERATIONS WITHIN AN "OPERATIONS ENVELOPE". AN EVALUATION TEST BED IS TO BE DEVELOPED IN THE '86 TIME FRAME FOR THE PURPOSE OF DEMONSTRATING THIS TELESCIENCE PAYLOAD CONTROL CONCEPT. IN PARALLEL WITH THE FOREGOING TASK, OPERATIONS CONCEPTS, SCENARIOS AND TECHNOLOGY DRIVERS FOR REMOTE USER PAYLOAD COMMAND AND CONTROL WILL BE INVESTIGATED.

USER INTERFACE AND PAYLOAD COMMAND AND CONTROL

OBJECTIVES:

- DEFINE FUNCTIONS OF THE SPACE STATION USER INTERFACE (SPACE & GROUND, CENTRAL AND REMOTE); DEVELOP DESIGN CONCEPT, BUILD/EVALUATE PROTOTYPE USER WORKSTATION (INCLUDING USER INTERFACE LANGUAGE)

- DEVELOP OPERATIONS CONCEPTS/SCENARIOS FOR SPACE STATION USER PAYLOAD COMMAND AND CONTROL OPTIONS; DEMONSTRATE CONCEPTS FOR IMPLEMENTING TELESCIENCE CAPABILITY

USER INTERFACE AND PAYLOAD COMMAND AND CONTROL

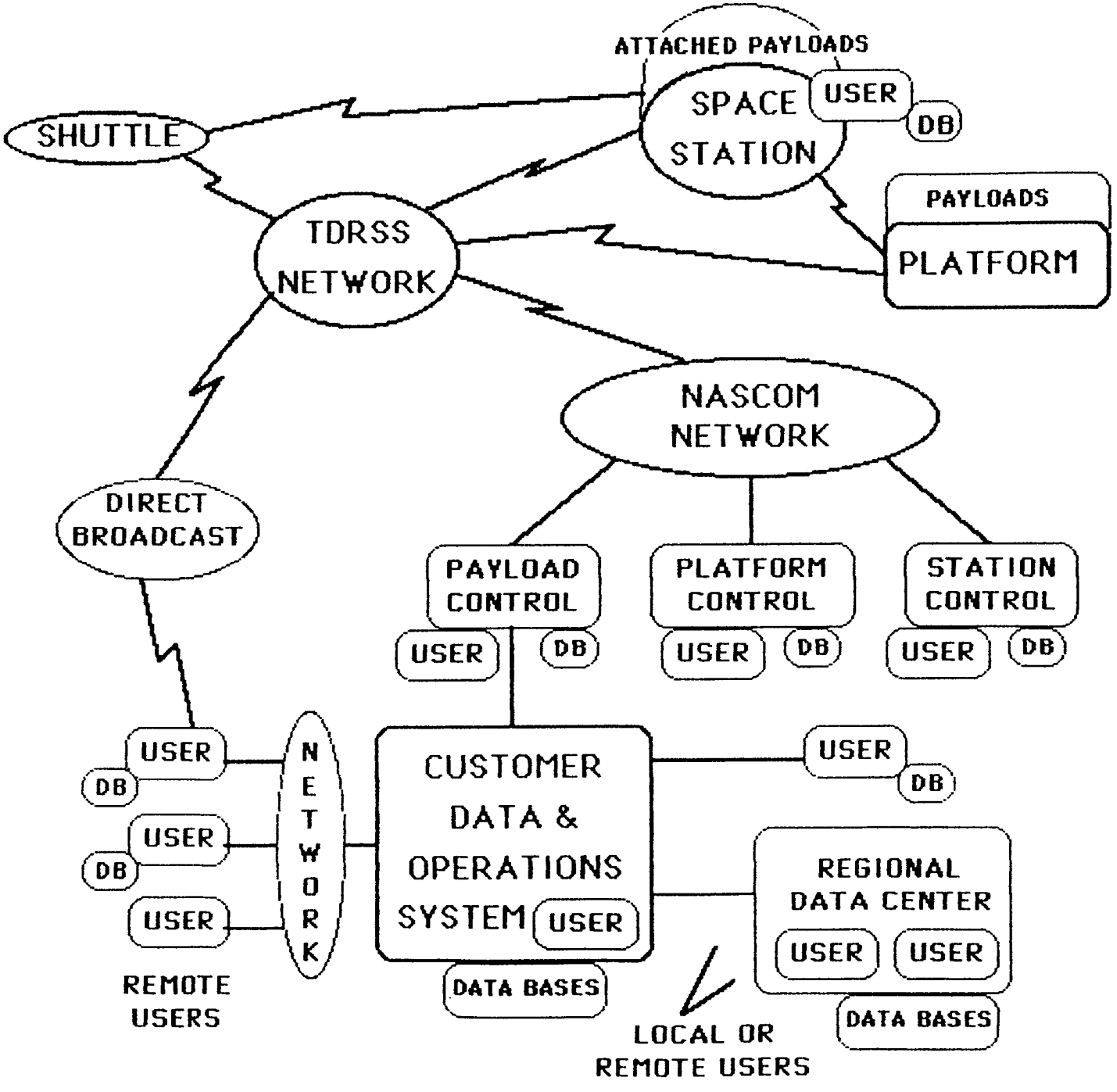
TECHNICAL CHALLENGES:

- MANY USERS WITH COMMON NEEDS BUT DIFFERENT VIEWPOINTS
  - FLIGHT, GROUND OPERATIONS, SCIENCE

- MANY USER FUNCTIONS AND INTERFACES TO SPACE STATION
  - ACCESS TO DISTRIBUTED DATA AND SERVICE CENTERS (REGIONAL CENTERS, CDOS, POCC'S, ETC.)
  - COMMUNICATIONS WITH REMOTE SYSTEMS (PAYLOAD, SPACE BASE, NETWORK, ETC.) AND OTHER USERS (INCLUDING CREW)

- MANY DIFFERENT WAYS OF OPERATING
  - ROUTINE PLAN VS DYNAMIC INTERACTION
  - LEVELS OF AUTONOMY AND AUTOMATION
  - IMPLICATIONS OF TELESCIENCE

POTENTIAL SPACE STATION OPERATIONAL INTERFACES



USER INTERFACE AND PAYLOAD COMMAND AND CONTROL

APPROACH AND PRODUCTS:

- USER INTERFACE LANGUAGE
  - TEAM-JSC, KSC, GSFC
  - REQUIREMENTS DEFINITION '85
  - USER EVALUATIONS '85-'87

- WORKSTATION
  - TECHNOLOGY WORKSHOP 3/85
  - DEVELOP WORKSTATION DESIGN CONCEPT '85
  - DEMO PROTOTYPE WORKSTATIONS '86
  - USER EVALUATIONS '86-'87

- TELESCIENCE
  - DEVELOP CONCEPT FOR "ENVELOPE OF OPERATIONS" '85
  - DEVELOP EVALUATION TESTBED '86
  - DEMO REMOTE PAYLOAD CONTROL '86-'87

WORKSTATION TECHNOLOGY WORKSHOP

HIGHLIGHTS:

- 40 PARTICIPANTS
  - 10 UNIVERSITY TECHNOLOGY EXPERTS
  - 4 GOV'T LIAISONS IN WORKSTATION TECHNOLOGY
  - NASA SPACE STATION REPS (SPACE & GROUND)
  - WORKSHOP FACILITATORS

- OVER 50 FORECASTS IN 7 AREAS GENERATED-
  - USER INTERFACE, VOICE, GRAPHICS, I/O DEVICES
  - LANGUAGES
  - DATABASE LANGUAGES AND MANAGEMENT
  - TRAINING AND SIMULATION
  - RESOURCE MANAGEMENT
  - COMMUNICATIONS
  - SOFTWARE DEVELOPMENT

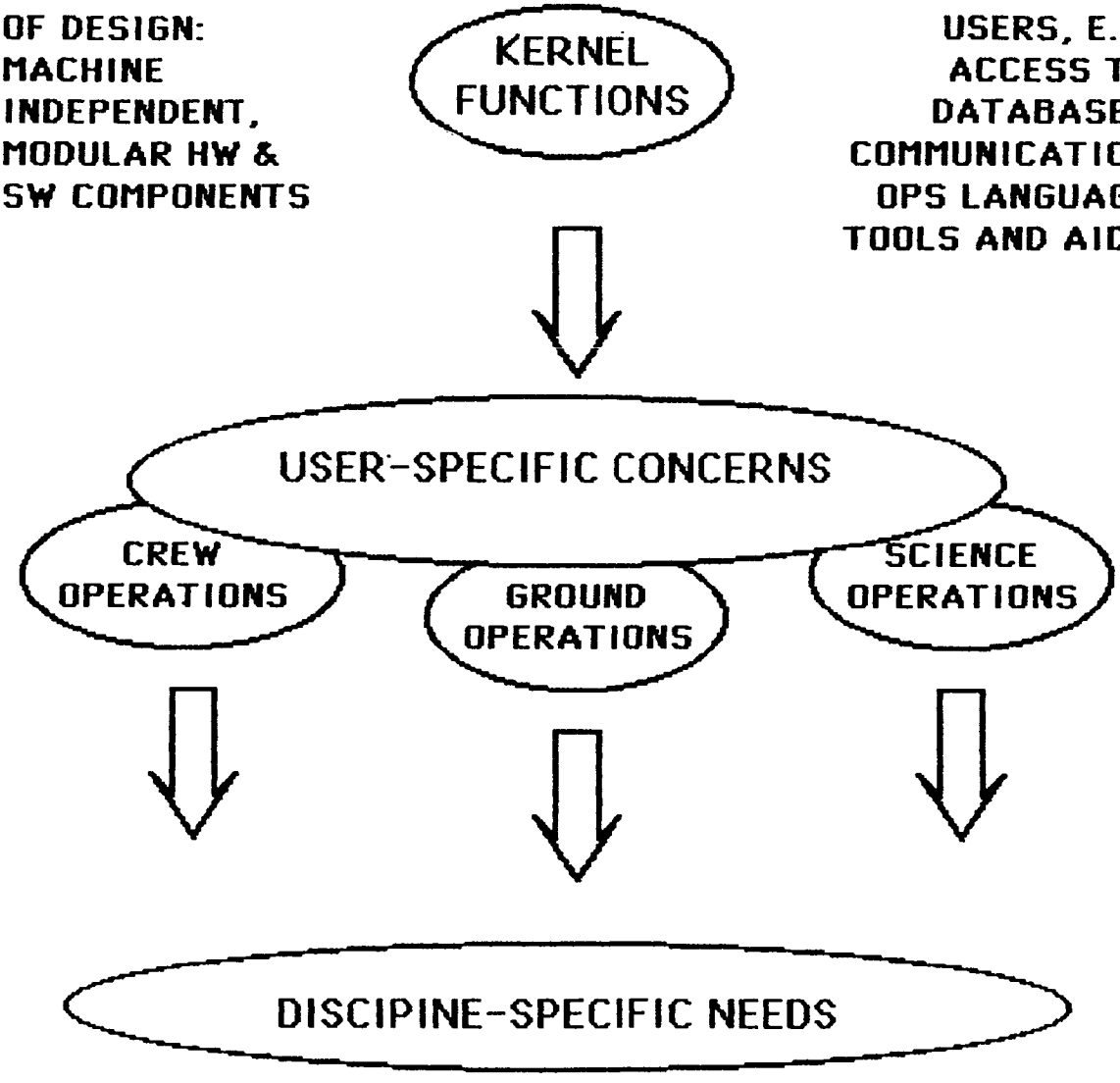
- PROMISING OR INNOVATIVE TECHNOLOGIES INCLUDED-
  - USER INTERFACE 'AUTHORING' TOOL
  - ICONIC LANGUAGES
  - DATA BASE FILTERING LANGUAGES FOR NON-SPECIFICALLY STRUCTURED DATA

- SIGNIFICANT TECHNOLOGY APPLICATION NEEDS INCLUDED-
  - SIMULATOR DEVELOPMENT TOOLS
  - RESOURCE SCHEDULING TECHNIQUES
  - EXPERT SYSTEM DEVELOPMENT TOOLS
  - AUTOMATED PROGRAM (CODE) GENERATION CAPABILITY

- RESULTS OF WORKSHOP WILL GUIDE DESIGN OF WORKSTATION MODULES AND IDENTIFY TECHNOLOGY APPLICATIONS

WORKSTATION DESIGN CONCEPT

KEY FEATURES OF DESIGN: MACHINE INDEPENDENT, MODULAR HW & SW COMPONENTS



COMMON FUNCTIONS REQUIRED BY ALL USERS, E.G.
ACCESS TO DATABASES
COMMUNICATION
OPS LANGUAGE
TOOLS AND AIDS

FLIGHT CREW
PAYLOAD SPEC.

SHUTTLE
SPACE STATION
SERVICING
PLATFORM
PAYLOAD
INSTRUMENT

ASTROPHYSICS
COMMUNICATIONS
EARTH & LIFE SCIENCE
MICROGRAVITY
PLASMA PHYSICS
PLANETARY

K. MOE
3/85

TELESCIENCE DESIGN CONCEPT DEFINITIONS

TELESCIENCE CONCEPT OF OPERATIONS - SPACE STATION USER IS PROVIDED THE ABILITY TO INDEPENDENTLY CONTROL PAYLOAD

INDEPENDENT OPERATIONS - ABILITY TO REMOTELY OPERATE A PAYLOAD WITHOUT COORDINATING OPERATIONS THROUGH AN EXTERNAL FACILITY (E.G., POCC); IMPLIES COMPLETE KNOWLEDGE OF CURRENT OPERATIONAL RESOURCE CONSTRAINTS AND CONFIDENT RELIANCE ON THE OPERATIONAL ENVIRONMENT

OPERATIONAL ENVELOPE - DEFINITION OF LIMITS OR BOUNDS ON: SHARED RESOURCES WHICH THE PAYLOAD MAY DEMAND; OPERATIONAL ENVIRONMENT REQUIRED BY THE PAYLOAD; AND OPERATIONAL ENVIRONMENT WHICH THE PAYLOAD MAY IMPACT

SHARED RESOURCES - RESOURCES PROVIDED ONBOARD BY THE HOST SPACE ELEMENT (E.G., PLATFORM), INCLUDING POWER, HOST'S ATTITUDE, COMMUNICATION BANDWIDTH, DATA STORAGE, DATA PROCESSING, PHYSICAL SPACE (FIELD OF VIEW)

OPERATIONAL ENVIRONMENT - CONDITIONS IN WHICH THE HOST OR PAYLOAD OPERATES, INCLUDING CHANGES IN ANGULAR MOMENTUM, VIBRATION/JITTER, PHYSICAL POSITION, THERMAL DISSIPATION, OUTGASSING/CONTAMINATION, ELECTROMAGNETIC RADIATION

TELESCIENCE DESIGN CONCEPT KEY FEATURES

- PRE-MISSION AGREEMENT BETWEEN NASA AND USER SPECIFIES OPERATIONAL ENVELOPE, I.E., LOWER BOUNDS ON GUARANTEED NASA SERVICES AND OPERATIONAL ENVIRONMENT, AND UPPER BOUND ON USER OPERATIONAL NEEDS

- ENVELOPE CAN DYNAMICALLY EXPAND OR CONTRACT (WITHIN SPECIFIED RANGE) ALLOWING MORE EFFICIENT USE OF RESOURCES

- INDEPENDENT OPERATIONS GUARANTEED WHILE USER OPERATES PAYLOAD WITHIN OPERATIONAL ENVELOPE

- FLEXIBILITY ALLOWS RE-ALLOCATION OF RESOURCES IN REAL TIME, ALSO EASIER TO ADAPT TO NEW PAYLOAD COMPLEMENT

- MINIMIZES NASA INVOLVEMENT IN PAYLOAD OPERATIONS, USER DEFINES NOMINAL OPERATIONS INTERFACE

- NASA MUST PROTECT ASSETS AND AGREEMENTS WITH ALL PAYLOAD USERS AGAINST USER ATTEMPTS TO OPERATE OUTSIDE OF ENVELOPE (E.G., USER PROVIDES PAYLOAD SAFING "BUTTON")

- PRICE OR OTHER INCENTIVES WILL EXIST TO INDUCE SELF REGULATION OF PAYLOAD DEMANDS ON ONBOARD RESOURCES, OPERATIONAL ENVIRONMENT

- SYSTEM MUST BE CAPABLE OF MAINTAINING HEALTH & SAFETY OF THE HOST ELEMENT UNDER ALL CIRCUMSTANCES; WILL DRIVE ONBOARD SENSOR, COMMUNICATION, AND DATA PROCESSING TECHNOLOGY

- APPROACH MINIMIZES NEED FOR COMMAND CHECKING

TELESCIENCE OPERATIONAL ENVELOPE